BC hydro

Application for an
Energy Project Certificate
Under Section 18 of the
Utilities Commission Act

Fraser Valley System Reinforcement Project

30 August 1991

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B.C. HYDRO

FRASER VALLEY
SYSTEM REINFORCEMENT PROJECT

APPLICATION FOR AN ENERGY PROJECT CERTIFICATE

UNDER SECTION 18 OF THE UTILITIES COMMISSION ACT

30 August 1991

This is Exhibit "A" referred to in the affidavit of JEFFREY BARKER Sworn to before me at the City of Vancouver in the Province of British Columbia on the 30th day of August 19 91.

A Commissioner for taking Affidavits for British Columbia

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AFFIDAVIT

IN THE MATTER of the Utilities Commission Act and the Regulations made thereunder;

AND IN THE MATTER of an application by the British Columbia Hydro and Power Authority for an Energy Project Certificate pursuant to Part 2, Section 18 of the Utilities Commission Act and B.C. Regulation 388/80.

I, JEFFREY BARKER, Civil Engineer, of the 10th Floor, 970 Burrard Street, Vancouver, British Columbia, make oath and say that:

1. I am a Project Manager, Project Management Division, British Columbia Hydro and Power Authority (B.C. Hydro) and as such I am authorized to make this Affidavit and sign, on behalf of B.C. Hydro, the Application under Section 18 of the Utilities Commission Act. The Application in connection with the Fraser Valley System Reinforcement Project is dated 30 August 1991 and a true copy is attached and marked Exhibit "A" to this my Affidavit.

2. The facts contained in the Application, are to the best of my knowledge and belief, true and accurate in all respects.

SWORN BEFORE ME at the City of Vancouver, in the Province of British Columbia, this 30th day of August 1991.

W.H. McQUEEN
A Commissioner for taking Affidavits for the Province of British Columbia

JEFFREY BARKER

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FRASER VALLEY SYSTEM REINFORCEMENT PROJECT
EXECUTIVE SUMMARY

B.C. Hydro submits this Application, pursuant to Section 18 of the Utilities Commission Act, for an Energy Project Certificate for the construction and operation of the Fraser Valley System Reinforcement Project (the "Project"). The Project is needed to meet the increased domestic demand for electricity in the south Fraser Valley area, and to maintain system reliability, efficiency, operating and planning flexibility, and is proposed to be in service by 31 October 1994.

The Project consists of constructing a 500/230 kV substation addition on property owned by B.C. Hydro adjacent to the existing 230 kV Clayburn Substation. The substation is located north of Abbotsford in the District of Matsqui. The Project also includes a 500 kV transmission line loop approximately 500 metres in length, to connect the 500 kV portion of the new substation to the existing Kelly Lake to Ingledow transmission line, Circuit 5L41, one of two 500 kV transmission lines which pass through the southern Fraser Valley.

B.C. Hydro has carried out detailed environmental and technical studies as well as a comprehensive public consultation program in connection with the project.

This Energy Project Certificate Application has been prepared and arranged in accordance with B.C. Regulation 388/80 and is presented in sections as follows:

A - Applicant
B - Project Description and Impacts
C - Project Justification
D - Ancillary Applications
E - Public Consultation Program

This Application presents information from a number of supporting documents. These documents provide project justification as well as details of the environmental and technical aspects of the substation site and transmission line route selection process and the public consultation program.

Accompanying this Application are the following supporting documents:

1. Fraser Valley System Reinforcement Project, Justification Report, B.C. Hydro, June 1991.

2. Fraser Valley System Reinforcement Project, Technical Report, B.C. Hydro, June 1991.

3. Fraser Valley System Reinforcement Project, Environmental Planning and Assessment Report, B.C. Hydro, June 1991.

4. Fraser Valley System Reinforcement Project, Report on the Interministerial Referral Process, B.C. Hydro, July 1991.

5. Fraser Valley System Reinforcement Project, Public Consultation Program, Context Research Ltd., 29 July 1991.

The supporting documents are also listed in the References section at the back of this Application.

TRANSMISSION LINES REFERENCED

B.C. Hydro CIRCUIT NUMBER	DESCRIPTION OF TRANSMISSION LINE
2L75	Existing 230 kV transmission line, Ingledow Substation to McLellan Substation (self-supporting steel structures, three double bundle conductors).
2L76	Existing 230 kV transmission line, McLellan Substation to Clayburn Substation (self-supporting steel structures, three double bundle conductors).
2L77	Existing 230 kV transmission line, Clayburn Substation to Atchelitz Substation (self-supporting steel structures, three double bundle conductors).
2L78	Existing 230 kV transmission line, Atchelitz Substation to Rosedale Substation (self-supporting steel structures, three double bundle conductors).
3L2	Existing 360 kV transmission line, Bridge River Terminal to Rosedale Substation via Lillooet and Harrison Lake (self-supporting steel towers, three double bundle conductors).
5L41	Existing 500 kV transmission line, Kelly Lake Substation to Ingledow Substation (guyed and self-supporting steel structures, three quadruple bundle conductors).
5L81	Existing 500 kV transmission line, Nicola Substation to Ingledow Substation (guyed and self-supporting steel structures, three quadruple bundle conductors).

SECTION A - APPLICANT

A.1 NAME, ADDRESS AND NATURE OF BUSINESS

British Columbia Hydro and Power Authority (B.C. Hydro) is a Crown Corporation established in 1962 under the British Columbia Hydro and Power Authority Act (as it was then). It has a head office at 970 Burrard Street, Vancouver, British Columbia, Canada, V6Z 1Y3. The principal business of B.C. Hydro is the generation, transmission and distribution of electricity.

A.2 FINANCIAL AND TECHNICAL CAPACITY OF THE APPLICANT

A.2.1 Financial Capacity

B.C. Hydro is an agent of Her Majesty the Queen in right of the Province. The Minister of Finance and Corporate Relations is the fiscal agent of B.C. Hydro, and B.C. Hydro may borrow money only with the approval of the Lieutenant Governor in Council, and then only up to amounts authorized by the Legislature.

B.C. Hydro has constructed some of the largest projects in the province undertaken by a single corporation and has had the financial capacity to undertake them by means of borrowing guaranteed by the Province, of borrowing directly from the Province, and by funds internally generated from the operation of its business. The credit ratings on B.C. Hydro bonds from the two major financial rating agencies in the United States, Moody's Investors Service and Standard & Poor's Corporation, are Aa1 and AA+, respectively. The ratings from the Canadian and Dominion Bond Rating Services in Canada are at AA+ and AA, respectively.

A.2.2 Technical Capacity

B.C. Hydro has been responsible for the planning, design and construction of generation and transmission facilities since 1962. Consultants with special expertise in engineering, environmental and public consultation matters are retained by B.C. Hydro from time to time to advise on various aspects of projects as required.

B.C. Hydro is one of the leaders in North America for the planning, design and construction of substations and high voltage transmission lines. Twenty-five 500 kV substations, as well as numerous 230 kV substations, have been designed and constructed.

B.C. Hydro has designed and constructed over 5300 km of 500 kV transmission lines within British Columbia.

A.3 NAME, TITLE AND ADDRESS OF PERSONS TO CONTACT WITH RESPECT TO THIS APPLICATION

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SECTION B - PROJECT DESCRIPTION AND IMPACTS

B.1 DESCRIPTION OF THE PROJECT, ITS PURPOSE AND COST

B.1.1 Introduction

The Fraser Valley System Reinforcement Project consists of constructing a 500/230 kV substation addition on property owned by B.C. Hydro adjacent to the existing 230 kV Clayburn Substation north of Abbotsford located in the District of Matsqui. The Project also includes a 500 kV transmission line loop of approximately 500 metres in length to connect the 500 kV portion of the new substation to the existing Kelly Lake to Ingledow transmission line, Circuit 5L41, one of two 500 kV transmission lines which pass through the southern Fraser Valley.

This site was selected from several available after detailed environmental, technical and public consultation studies were carried out. Technical, Environmental, Project Justification and Public Consultation reports are referenced in and form part of this Application.

This sub-section provides information on the technical details of the project, the proposed and alternative sites, the project purpose and the project cost.

B.1.2 Technical Details

B.1.2.1 Existing System

Existing major transmission lines and substations located in the south central Fraser Valley are outlined on Figure 1. These lines and substations operate at 500 kV, 360 kV, 230 kV and 69 kV. From the transmission voltage substations, distribution voltage lines (12 kV and 25 kV) service the Fraser Valley. The major transmission corridor in the southern Fraser Valley runs east to west from Rosedale to Ingledow transmitting electrical energy from the large generation plants in B.C.'s Interior. This corridor presently contains two steel lattice tower 500 kV transmission lines named Circuit 5L81 and Circuit 5L41 and a single steel lattice tower 230 kV transmission line (circuits 2L75, 2L76, 2L77 and 2L78). The 500 kV lines originate from Nicola Substation (5L81)

near Merritt and Kelly Lake Substation (5L41) near Clinton. The 230 kV line located on the south side of the corridor supplies electrical energy to the south central Fraser Valley between Ingledow (500/230/69 kV) Substation and Rosedale (360/230 kV) Substation to the following substations:

(a) McLellan (230/25 kV) Substation located near Langley, in Surrey;

(b) Clayburn (230/25 kV) Substation located north of Abbotsford, in the District of Matsqui; and

(c) Atchelitz (230/69/25 kV) Substation near Yarrow in Chilliwack.

B.1.2.2 Description of the Clayburn Site

Figure 2 shows the existing Clayburn Substation site, the proposed 500 kV substation addition and the proposed routing for the transmission line loop. B.C. Hydro owns the property adjacent to the existing 230/25 kV substation, on which the proposed 500 kV switchyard and 500/230 kV transformation will be located. B.C. Hydro has an existing transmission line right-of-way from the transmission corridor into the substation site.

Clayburn Substation is a 230/25 kV substation located about 0.5 km west of Highway 11 off Valley Road in the District of Matsqui. The present station was developed in the early 1980s to meet the growing demand for electricity in Abbotsford, the District of Matsqui and Aldergrove. The legal description of the Clayburn site is Lots 10-15, Plan 2173 and Lot 64, Plan 66729, New Westminster District. It was acquired in 1979. The site is zoned Agriculture 3 and is designated Agricultural in the official Community Plan. The property area is approximately 12 ha. in area and is foreseen to be of sufficient size to accommodate present, planned and ultimate station requirements.

Site access is from Highway 11 and Valley Road. The Southern Railway and Canadian Pacific Railway tracks are both located to the east of the site.

The Clayburn Substation site is located on top of a small terrace which was previously used as a gravel pit. The site slopes uphill to the north and downhill to the south to the flats of the Willband Creek drainage. Soils at the site are complex and consist of silt, clay, sand and gravel with only a limited amount of the material being suitable as fill.

A 230 kV wood pole transmission line loop (circuits 2L76 and 2L77), from the lattice steel 230 kV line between Ingledow and Rosedale, enters the south face of the station. Various distribution circuits emanate from the north-east face of the station and head easterly towards Highway 11 and west towards Gladwin Drive. The major transmission 500/230 kV corridor is located 500 metres to the south of the existing substation.

The transmission line right-of-way acquired from the District of Matsqui and Abbotsford in 1984, is approximately 330 metres in width. It is wide enough for the two proposed 500 kV single circuit lines and the two existing 230 kV wood pole lines.

The existing 230 kV loop crosses the Willband Creek flood plain over an area immediately east of a previously used sewage lagoon. In the mid 1980s use of the sewage lagoon was discontinued and the area (including the area beneath the 230 kV lines) was converted to a landfill for materials not accepted by other landfills. This use continues to the present time.

The old sewage lagoon and existing landfill site is surrounded by a leachate control system and there is an above ground sewer line adjacent to the north boundary of the 500/230 kV transmission corridor. The Willband Creek floodplain is designated as a Development Permit Area by the District of Matsqui.

B.1.2.3 Substation Overview

The substation layout will initially accommodate two 500 kV terminations and one bank of 500/230 kV transformation. A second transformer bank would be added, as required, in a later stage of development.

(a) Equipment

New equipment installed as part of a 500 kV substation will include:

- four 500/230 kV single phase transformers each rated 200 MVA and arranged as a three phase bank with one spare
- three 500 kV circuit breakers
- two 230 kV circuit breakers
- 500 and 230 kV disconnect switches, potential devices and surge arresters, as required

(b) Control Facilities

Substation equipment will be controlled from the Burnaby Mountain Control Centre or the substation site. Appropriate control systems to serve this purpose will be installed.

(c) Substation Size

The substation addition at Clayburn will be an outdoor non-standard compact design. This design will minimize site development costs yet satisfy topographical and site condition constraints. Site area required is reduced by approximately 30% compared to a conventional design.

Due to the topographical constraints, the four single phase transformers will be located on the east side of the station access road and a bus or aerial span will be required for connection of the 500 kV switchyard and the transformers which will be located on the west side of the substation access road.

The site requirement for the 500 kV substation addition will be approximately 1.5 to 2 ha. All site development will occur on property owned by B.C. Hydro.

B.1.2.4 Transmission Line Loop Overview

Connection of the 500 kV substation to Circuit 5L41 will require a three phase single circuit 500 kV in and out transmission line loop (two lines). The transmission line loop will be from Circuit 5L41 because of voltage stability and operating considerations.

Circuit 5L41 was constructed in the mid 1960s as part of the Portage Mountain Development (Bennett Dam/G.M. Shrum Generating Station). The length of the circuit between Kelly Lake Substation and Ingledow Substation is 320 km. Groundwire protection is currently provided for approximately 1.6 km from each substation.

Conductor specifications and ratings, and tower clearances (air gap) for a transmission line loop will match those of Circuit 5L41 and will be constructed with 316.1 mm^2 (623.8 MCM) ACSR conductor installed in a bundle of four on each of the three phases and a 1167 mm^2 (2303.5 MCM) ASC conductor installed as a bundle of two on each of the three phases (for slack spans). The length of each half of the transmission line loop is approximately 450 metres.

Overhead groundwires will be installed for approximately 1200 metres east and west on 5L41 from where the transmission line loop connects to the existing line encompassing an area between the east side of Highway 11 to just west of Gladwin Road in the District of Matsqui requiring the retrofitting of approximately 10 existing towers on 5L41.

The transmission line loop will cross beneath the northerly 500 kV Circuit 5L81. To provide adequate clearance beneath 5L81 the conductors of 5L81 will be raised at the crossing point by installing a new lattice steel tower.

A total of six new single circuit 500 kV self-supporting lattice steel towers supporting three conductors in a horizontal (or flat) configuration will be installed for the transmission line loop (three for each half of the loop). One additional single circuit self-supporting lattice steel tower will be installed on 5L81 to raise the conductors. The new towers will be similar in appearance and

height (varying from 19 to 30 m in height) as the existing towers on the transmission line corridor.

There will not be substantial clearing of vegetation. The only exception will be low growing deciduous trees and shrubs which will be felled by hand methods.

B.1.3 Purpose of the Project

Reinforcement of the electrical system facilities in the south central and eastern Fraser Valley (includes supply to the Fraser Canyon) is required to meet the increasing demand for electricity in the area. This area encompasses the Langley, Matsqui, Abbotsford and Chilliwack municipalities in the south central Fraser Valley, as well as Hope to Boston Bar in the Fraser Canyon.

Most of the electrical energy to the south central and eastern Fraser Valley is transmitted on a 230 kV transmission/substation system supplied primarily from Rosedale Substation near Chilliwack B.C. to the east and Ingledow Substation in Surrey, B.C. to the west. Rosedale Substation connects to Bridge River Generation, west of Lillooet and to Wahleach Generating Station, east of Chilliwack. Most of the electricity transmitted along the 230 kV transmission line through the southern Fraser Valley is from Bridge River generation. The ability of B.C. Hydro to provide electricity to its customers in the south Fraser Valley may be compromised if one of the transmission lines from the west or east is out of service. As we approach the mid 1990s the total demand for electricity , primarily in the south central Fraser Valley, is expected to exceed the capacity of the existing system.

B.1.4 Project Cost Estimate

The total estimated project cost including inflation, corporate overhead and interest during construction is $30,486,000 (1990$) made up as follows:

Project Component	Estimated Cost (1990$ - $000s)
Substation	18,736
Transmission Line Loop	2,398
Project Study and Application	818
Total Direct (1990$)	21,952
Inflation	3,223
Corporate Overhead	2,283
Interest During Construction	3,028
Total Estimated Project Cost	30,486

B.2 TIMETABLE

The proposed in-service date for the project is 31 October 1994. The project schedule is outlined in Figure 3.

B.3 PUBLIC WORKS

There are no new public works required for this project.

B.4 IDENTIFICATION AND PRELIMINARY ASSESSMENT OF IMPACTS

B.4.1 Introduction

B.C. Hydro commissioned a series of studies of the terrestrial, aquatic and social resources of the proposed project as well as feasible project alternatives. These studies were undertaken as part of the environmental assessment program for the proposed system reinforcement.

The studies were undertaken by consultants retained by B.C. Hydro and while each had specific terms of reference, they all worked collectively to prepare and interpret data and information on the natural and social resources of the area influenced by the proposed project and its

alternatives. This information was used to determine the nature and degree of potential project impacts, mitigation techniques available to reduce the impacts and to select the most environmentally effective alternative.

This was used by B.C. Hydro in the preparation of an Environmental Planning and Assessment Report which outlines the criteria used in the selection of Clayburn Substation as the environmentally best option in comparison to the other alternatives studied. This report also describes the nature and extent of potential environmental impacts related to the construction of the proposed project at Clayburn, as well as the mitigation techniques which could be employed to reduce or eliminate the impacts.

The following material summarizes the potential impacts identified by the environmental studies. The assessment of the impacts and the strategy for their management will be assessed in greater detail during the design and construction stage. Environmental impacts will be managed in the context of sustainability which will involve a commitment to natural resource maintenance and enhancement. Concerns raised during the planning and the licensing process will be included in an Environmental Management Plan. Environmental inspectors, employed during the construction and immediate post-construction phases of the project, will ensure that the environmental commitments outlined in the Environmental Management Plan are fulfilled. They will work closely with construction and regulatory agency personnel.

B.4.2 Description of Alternatives and Site Selection

At the outset of this project, studies were initially undertaken on the basis of a two part project. One part included a proposed transmission line interconnection with Puget Sound Power and Light (PSPL), a utility located in Washington State. The second part was the examination of sites that could be used to reinforce the electrical system to meet the growing demand for electricity in the south central Fraser Valley area. These two projects were studied together since substation requirements of both projects could possibly be met by utilizing the same site. During these studies, five sites were identified as alternatives that would meet these requirements. All of these sites satisfied the potential route options for the transmission line intertie with PSPL. One of these sites was the existing Clayburn Substation.

Following the decision by B.C. Hydro in the late summer of 1990 to wind down any further studies on the intertie part of the project, B.C. Hydro continued to study the reinforcement of the electrical system to meet electricity needs in the south central Fraser Valley. A number of alternatives that would potentially meet these requirements over a short and long-term period were identified.

Three such alternatives which involved the construction of a 500/230 kV substation at one of the existing 230 kV substations in the Fraser Valley (namely at the Atchelitz Substation near Chilliwack, at the McLellan Substation in Surrey and at the Clayburn Substation in the District of Matsqui) were deemed the most suitable. Accordingly, detailed environmental, technical and public consultation studies were carried out on these alternatives.

Other alternatives that were identified, together with a summary of the reasons why these alternatives were less acceptable, are:

(a) The construction of a heavy duty single circuit three phase 230 kV transmission line between Ingledow Substation and McLellan Substation, a distance of approximately 16 km, and the provision of 230 kV additions at both the Ingledow and McLellan 230 kV substations. Concerns with this alternative include:

- this alternative will only support the anticipated load growth for approximately 15 years

- some new transmission line right-of-way will be required through increasingly developed areas

(b) The installation of series compensation on the 360 kV transmission line circuit (3L2) between Bridge River Generation Station and Rosedale Substation (midway between Bridge River and Rosedale which would locate the site along the west side of Harrison Lake). Concerns with this alternative include:

- the alternative would only support the anticipated local growth for approximately five years

- the alternative would have no benefit to the supply problem in the Fraser Canyon area

(c) The installation of a dynamic voltage device (Static VAR compensator) at Clayburn 230 kV Substation to remove the voltage imposed limitations on the Bridge River transmission line circuit. Concerns with this alternative include:

- the alternative will only support the anticipated load growth for approximately four years

- this alternative is less reliable and flexible than a 500/230 kV substation

Detailed environmental and technical studies were not carried out on these less acceptable alternatives, nor were they included in the public consultation program. Table 1 provides an assessment of the six alternatives.

Table 1 provides a summary of the assessment of these six alternatives (a more detailed analysis and assessment can be found in technical, environmental and justification reports accompanying this application). The evaluation concluded that the most viable alternatives were the addition of a 500 kV substation adjacent to the site of one of the three existing 230 kV substation sites in the south central Fraser Valley (namely, McLellan, Clayburn and Atchelitz).

The comparison of these three alternatives, as illustrated in Table 1, concluded:

- on a technical basis, Atchelitz is considered slightly superior to Clayburn

- on an environmental basis, Clayburn is considered the best alternative

- on a system planning, economic and financial feasibility basis, Clayburn is considered the best alternative

Based on these criteria, and the conclusion from the public consultation program that there is public support for the use of the Clayburn alternative in comparison with others, Clayburn Substation was considered the best overall choice. While not discounting either Atchelitz or McLellan substations, Clayburn became the main focus of the project planning studies.

An Interministerial Referral Process was implemented by B.C. Hydro in order to determine concerns that government agencies may have with respect to the proposed project. The conclusion of this process is provided in the report accompanying this application.

B.4.3 General Environmental Issues with Respect to Clayburn Substation

B.4.3.1 Water Quality and Use

Willband Creek, located southeast of the Clayburn Substation, is the major drainage basin in the area, flowing northward into the Fraser River.

There are three registered groundwater wells in the vicinity of the Clayburn area with an additional well location immediately outside of the western boundary of the substation. There are four registered surface water licences east of the site near the CPR railway, well away from any proposed construction activity.

The management of these potential impacts will include:

(a) avoidance of any clearing or construction near surface water intakes or groundwater wells;

(b) grounding of fences, metallic buildings, above-ground well sidings and spanning the wells and water intakes;

(c) keeping all construction activity, including access roads, at least 10 metres away from the pipes and ditches located around the perimeter of the old sewage lagoon/landfill except where crossings are required subject to the approval of appropriate agencies.

B.4.3.2 Fisheries

While there are no aquatic resources in the Clayburn Substation property, fisheries resources are found in Willband Creek. Willband Creek is reported to contain spawning coho and cutthroat trout, and possibly steelhead.

Willband Creek will not be directly affected by the construction of the proposed expansion to the substation. While it will be crossed by the 500 kV transmission line loop, additional vegetation removal or water control in the floodplain for the purposes of construction and right-of-way management are not expected.

The management of these potential impacts will include:

(a) no removal of riparian vegetation along Willband Creek;

(b) avoidance of construction during heavy rainfall when working in close proximity to Willband Creek and ditches which flow into the creek;

(c) recontouring and revegetation of disturbed soils immediately following construction and within the same growing season;

(d) appropriate pesticide free zones near streams or drainage ditches;

(e) adherence to Fisheries and Oceans Canada, and Ministry of Environment (Fish and Wildlife Branch, and Water Management Branch) guidelines and specifications, including limiting work to the appropriate construction window, when working near Willband Creek.

B.4.3.3 Wetlands and Floodplains

While there are no wetlands within the Clayburn Substation property, the Willband Creek floodplain contains wetlands that function as natural storm water retention areas. The District of Matsqui has designated a portion of this area as a Development Permit Area under the Official Community Plan. The objective of this designation is to protect downstream land and development from flooding.

The management of potential impacts will include.

(a) compliance with guidelines under the Willband Creek Floodplain Development Permit when constructing the 500 kV transmission line loop;

(b) minimizing the amount of fill needed for construction within the floodplain and removal of the fill where possible.

B.4.3.4 Visual and Recreation Resources

The expansion of the Clayburn Substation and construction of the 500 kV transmission line loop will be visible to the east, south and west of the site. However, due to the existing facilities in the general area such as the transfer station, garbage disposal area and landfill, this expansion will not adversely affect the appearance of the landscape.

The 500 kV transmission line loop will cross the capped and seeded landfill south of the substation which has been proposed by the District of Matsqui for future development of playing fields. It is anticipated that development of the playing field complex will occur in the long-term, well after construction of the proposed loop.

The long-term use of the landfill for playing fields is not anticipated to be adversely affected by the 500 kV transmission line loop.

The management of potential impacts will include:

(a) Recontouring and revegetation of disturbed areas to aid in screening the substation.

(b) Keeping the 500 kV transmission line loop as close as possible to the existing 230 kV lines.

(c) Avoiding, where possible, tower locations for the 500 kV transmission line loop within the proposed playing field area.

B.4.3.5 Heritage and Archaeological Resources

In general, there is a low potential for heritage resources to be found in the proposed project area. The only minor exception is in the southwest corner of the substation property.

This area will be examined by a qualified archaeologist prior to any clearing or construction activity. Information from this study will be used in the preparation of the Environmental Management Plan.

B.4.3.6 Wildlife

Due to the past industrial use of the area proposed for the 500 kV transmission line loop and substation expansion, there is essentially no intact wildlife habitat present. The only exception to this is the Willband Creek floodplain area where nesting sites for waterfowl, passerine birds and raptors may exist.

This area will be examined prior to construction in order to ensure that these activities do not cause habitat or nesting disturbance.

B.4.4 Specific Environmental Issues

B.4.4.1 Electromagnetic Fields (EMF)

Additions to Clayburn Substation and the 500 kV transmission line loop are remote from the adjacent developed lands. This will minimize any change in exposure to EMF for existing homeowners.

The following is a brief summary of the understanding of EMF and our environment.

Extensive studies have been carried out by scientists on the effects of EMF on human beings, laboratory animals, isolated cells and tissues, and livestock (both in the laboratory and in natural settings).

Laboratory studies of humans exposed to intense EMF have not observed changes in basic physiologic and mental processes (such

as blood pressure, temperature, sleep, appetite, physical functions, mood and behaviour).

However, these studies have documented that very strong electric fields can sometimes be felt by the stimulation of body hair. Other documented effects include other minor changes which are generally viewed as not harmful.

Two recent epidemiological studies of childhood cancer have shown a weak correlation between cancer cases and proximity to certain types of distribution lines. However, association was not found between childhood cancer and measured magnetic field levels.

The consensus of scientific and governmental panels, after evaluating all of the available data, is that no risk has been established to human health resulting from exposure to electric or magnetic fields from power transmission lines.

It is recognized that there is widespread public interest in the issue of human health risks from EMF. B.C. Hydro has followed scientific developments, evaluated public and employee exposure, and participated in utility and technical forums on the subject. B.C. Hydro has recently provided funding to five health related studies by independent university and cancer agency researchers, and has a project manager to deal specifically with this important issue.

B.C. Hydro is committed to the search for a better understanding of EMF effects and will continue to provide the latest information to the public and its own workforce.

B.4.4.2 Landfill Stability and Worker Safety

The soil conditions in the vicinity of the landfill will require examination in regard to ground stability to ensure adequate foundations. In particular, if excavations are required in the landfill, it will be necessary to determine the presence of flammable and asphyxiant gases.

B.4.4.3 TV and Radio Reception

Based on over 20 years experience with the design and operation of 500 kV systems throughout the province, B.C. Hydro believes that the proposed 500 kV transmission line loop and substation addition will not increase television interference within the vicinity of the transmission line and substation. Canadian Standards Association (CSA) CAN3-C108.3.1-M84 states that generation of VHF noise (i.e. electromagnetic noise in the VHF television frequencies) is not usually an inherent property of a power line and B.C. Hydro also believes this is the case for electrical substations.

Radio noise generated by the substation is believed to be less than that associated with a 500 kV transmission line. For transmission lines, the CSA Standard includes a guideline for maximum radio noise of 57 dB at a lateral distance of 15 m from the outside conductor during fair weather. This same standard has been adopted by the federal Department of Communications in its proposed amendments to the radio interference regulations. The calculated maximum radio noise at this same lateral distance from the proposed 500 kV transmission line loop is 46 dB or less depending on tower configuration, which is below the CSA guideline.

During periods of rain, snow or fog, radio noise levels will increase, but no guideline levels are provided in the CSA Standard.

B.4.4.4 Audible Noise

B.C. Hydro believes that audible noise levels associated with the proposed substation addition will be less at the perimeter of the substation, than those of the 500 kV transmission line loop. For the proposed 500 kV transmission line loop, it is estimated that the maximum audible noise level at the edge of the right-of-way during wet conditions (worst case) would be 48 dBA or less depending on tower configuration and the location of the transmission line loop relative to the existing circuits. Audible noise levels during fair weather would be lower. There are no CSA guidelines for audible noise.

SECTION C - PROJECT JUSTIFICATION

C.1 SYSTEM PLANNING, ECONOMIC AND FINANCIAL FEASIBILITY OF THE PROJECT

This section summarizes the results of system planning and economic studies of the proposed 500/230 kV transformation facilities at the existing Clayburn Substation site by the fall of 1994. Further detail can be found in the Project Justification Report referred to in this application.

B.C. Hydro's mission is to support the development of British Columbia through the efficient supply of electricity. B.C. Hydro has a responsibility to provide reliable electric service to its customers.

A transmission system is a network of transmission lines which delivers electricity from the generation sources to switching stations and distribution substations. Electricity is then distributed from these distribution substations to individual consumers. The power transfer capability of the transmission system is determined by computer simulation studies. The adequacy of this transmission capability is judged by its compliance with B.C. Hydro's single contingency planning criteria.

The existing transmission system in south central Fraser Valley area is shown in Figure 1. Two 500 kV transmission lines and one 230 kV transmission line share a common right-of-way through most of the Fraser Valley. One 500 kV line originates at Kelly Lake in the Central Interior, the other at Nicola in the South Interior. Both terminate at Ingledow Substation in Surrey. The 230 kV transmission line links Rosedale, Atchelitz, Clayburn, McLellan and Ingledow substations. Loads in the south central and eastern Fraser Valley areas are supplied from both ends of the 230 kV line, that is, from Ingledow and Bridge River (which is tied to Rosedale via a 360 kV line).

Most of the demand for electricity in the south central and eastern Fraser Valley is centred in Langley (near McLellan Substation) and Abbotsford/Matsqui (near Clayburn Substation) area. If the 230 kV circuit between Ingledow and McLellan is not available for service, most of the Fraser Valley load south of the Fraser River will have to be supplied from Bridge River. Recent load forecasts show

that the Bridge River to Rosedale transmission line will reach its capability in 1994, based on maintaining acceptable voltages to all stations supplied from Rosedale on outage of the Ingledow-McLellan 230 kV circuit.

The most effective solution to strengthen the Fraser Valley 230 kV system is to introduce a third source onto the 230 kV transmission line by looping an existing 500 kV circuit into a new 500/230 kV substation at an existing 230 kV substation along the transmission circuit. Three alternatives were examined in detail. They are:

(a) Construct a 500/230 kV substation at the existing Atchelitz Substation site. Atchelitz Substation is not close to areas of high electricity demand and load growth. When compared with Clayburn alternative or McLellan alternative, there will be additional transmission losses as electricity has to be transmitted from Atchelitz to the Langley and Abbotsford/Matsqui area. The alternative would meet the anticipated area load demand for 20 years.

(b) Construct a 500/230 kV substation at the existing Clayburn Substation site. The site is located at the load centre of the 230 kV system. Reinforcement at Clayburn Substation will save on transmission losses and would meet the anticipated area load demand for over 30 years. The Clayburn alternative is the lowest cost alternative in the long-term.

(c) Construct a 500/230 kV substation at the existing McLellan Substation site. Reinforcement at McLellan Substation will also save on transmission losses. The McLellan alternative is the most expensive alternative and only would meet the anticipated area load demand for 15 years.

C.2 PROJECT BENEFIT AND COST ANALYSIS

The benefit-cost analysis for the proposed Fraser Valley System Reinforcement Project was based on the assumption that any new load must be served reliably and economically. Any conservation and/or reduced development will slow down the demand for electricity in the area and will defer, but not eliminate, the need for future transmission reinforcement. Since the lead time for building a 500/230 kV substation at Clayburn is at least three years, conservation would not influence the initiation of the project but could have a significant impact on its completion date.

The three reinforcement alternatives have different supply capabilities. In the cost analysis, it was assumed that when the supply capability of the alternative is exceeded, a new 500/230 kV substation along the 230 kV transmission circuit will be built. The project cost estimates, in 1990 dollars, for the three alternatives are summarized below:

Cost Component	Atchelitz Alternative ($000s)	Clayburn Alternative ($000s)	McLellan Alternative ($000s)
Transmission Line Loop	$ 1,186	$ 2,398	$ 2,427
Project Study and Application	818	818	818
Substation	18,800	18,736	25,000
Subtotal (direct)	$20,804	$21,952	$28,245
Inflation	3,012	3,223	4,168
Corporate Overhead	2,160	2,283	2,935
Interest During Construction	2,966	3,028	3,825
Total Estimated Project Cost	$28,942	$30,486	$39,173

The energy lost in the transmission of electricity from the generating source to the consumers is known as transmission losses. These losses for the Clayburn and McLellan alternatives are almost the same and are less than the Atchelitz alternative. The additional transmission losses for the Atchelitz alternative amount to $272,000 annually.

The cumulated present-worth cash flows, in 1990 dollars and at 8% discount rate, of the three alternatives for a 30-year study period are listed below. The calculation takes into account the additional transmission losses for the Atchelitz alternative and the required system reinforcement in the later part of the study period for Atchelitz alternative and McLellan alternative.

Atchelitz Alternative:	$22,685,000
Clayburn Alternative:	$17,467,000
McLellan Alternative:	$27,160,000

Clayburn alternative is the least cost alternative. The cost analysis was tested using 4% and 12% discount rate. It shows that the ranking of the alternatives, based on long-term cost, will not be affected by discount rates.

Clayburn Substation is strategically located at the centre of load demand. Based on system planning and economic evaluations, Clayburn appears as the best alternative to reinforce the Fraser Valley 230 kV transmission system.

SECTION D - ANCILLARY APPLICATIONS

D.1 WASTE MANAGEMENT ACT AND WATER ACT

Approvals, permits and licences may be required under the Waste Management Act and the Water Act for construction work. Such permits are not being sought as part of this present Application but will be sought if this Application is approved.

D.2 OTHER APPROVALS, PERMITS, OR LICENCES THAT MAY BE REQUIRED

The following also may be required in connection with the proposed project:

(a) Special case authorizations under the Agricultural Land Commission Act.

(b) Approvals under the Heritage Conservation Act.

(c) Approvals under the Fisheries Act (Canada).

(d) Miscellaneous approvals, permits and licences routinely required from time to time for construction work.

SECTION E - PUBLIC CONSULTATION PROGRAM

E.1 INTRODUCTION

As part of B.C. Hydro's study to reinforce the transmission system in the south central Fraser Valley, a proactive public involvement program was implemented. The goal of this program was "to improve planning for the transmission system reinforcement by incorporating public ideas and concerns into the planning process".

The public involvement program began in July 1989 when B.C. Hydro initiated planning studies for reinforcement of the transmission system in the Fraser Valley and, secondly, a 230 kV transmission line intertie with the Puget Sound Power and Light Co. (PSPL) of Bellevue, Washington. Consultation for both projects occurred simultaneously from the fall of 1989 to August 1990, at which time B.C. Hydro decided to wind down any further studies on the intertie project because of agreements reached among B.C. Hydro, PSPL, and the Bonneville Power Administration (BPA). Planning and public consultation for the system reinforcement continued during the latter part of 1990, and was completed in July 1991. Key steps in the public consultation program are shown in Table 2.

E.2 PUBLIC INVOLVEMENT PROCESS

In August 1989, the project team met with local and regional government officials in and around the study area to inform them about the intertie and the substation reinforcement[1], and to obtain their response to the consultation program and to identify potential issues. Meetings were held with the City of Langley, the Districts of Matsqui and Abbotsford, and the Township of Langley.

Following these initial meetings, the project team issued a press release to newspapers in the region, and mailed over 20,000 newsletters to households in the Aldergrove, Abbotsford, Matsqui and Sumas Prairie areas. The newsletter provided detailed information on the two projects, and outlined future public involvement initiatives. Five public meetings and a series of discussion sessions with residents and interest groups were held prior to December 1989. These sessions were designed to provide information about the intertie and substation

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1 While not technically correct, the term "substation reinforcement" has been used to assist the public in understanding the scope of the project. Actually, it is the 230 kV transmission line system that is being reinforced, but since most of the work involves the addition to an existing substation, the term "substation reinforcement" has been used. In some cases the term "system reinforcement" has also been used.

reinforcement projects, and to obtain public input into the identification of alternative site and route selection planning opportunities and constraints.

As the planning process continued into the first six months of 1990, participants were kept informed by response to inquiries, information distribution and direct contact. Meetings with local and regional governments, small group discussion sessions, and door to door canvassing of residents took place from May to July 1990. A second newsletter was sent to approximately 30,000 residents in the study area in July 1990 to provide more detailed information on possible intertie routes and substation locations. Correspondence and a copy of the newsletter were also sent to the mail list in July to ensure that all participants had received information on the substation and intertie planning options.

In August 1990, a decision was made to wind down planning studies for the intertie although planning for the substation reinforcement would continue. This represented the completion of Phase 1 of the public involvement program, and all persons on B.C. Hydro's mail list were informed by mail about the change in the planning studies.

At the completion of Phase 1, relatively few concerns had been expressed about the substation reinforcement. The majority of participants felt that reinforcement would benefit the south central Fraser Valley, and there was support for locating the project at an existing substation location such as Clayburn in the District of Matsqui.

Winding down the studies for the intertie focused the evaluation on alternative sites for substation reinforcement. This resulted in the two other existing substations being evaluated in addition to Clayburn, namely McLellan Substation in Langley and Atchelitz Substation near Chilliwack. Technical and environmental analysis of all three sites were presented to the public as part of the Phase 2 consultation process.

In November 1990, discussion sessions were held with planning and engineering staff in the Districts of Matsqui and Abbotsford to present the results of the substation planning study. The municipalities identified support for the substation reinforcement at Clayburn as a means to meet future electricity demand.

In April 1991, a third newsletter was developed specifically for the substation reinforcement project. The newsletter was sent to those residents in the area surrounding the Clayburn Substation in the District of Matsqui, to local and regional governments responsible for the Langley, Matsqui, Abbotsford and

Chilliwack areas, and to community ratepayers associations. The newsletter provided a toll free telephone number for interested persons to contact B.C. Hydro to obtain information and to express their views. A clip-out form was also provided for interested persons to make comments which could be forwarded to B.C. Hydro.

The newsletter was followed by an advertisement which appeared twice in local newspapers in Matsqui, Abbotsford, Aldergrove and Langley during the weeks of 27 May and 3 June 1991. The advertisement provided background information on the substation reinforcement and a map of the Clayburn Substation area. A clip-out form and B.C. Hydro's toll free information telephone number were provided for the public to express their views on the project in writing or by calling B.C. Hydro.

Following the distribution of project information and notification to the public, members of the project team contacted representatives of local and regional governments, ratepayers associations and residents within the viewshed of the Clayburn substation and its transmission line connection. This involved direct door-to-door contact with residents to discuss any concerns they may have about the project.

Methods employed are detailed in the respective reports referenced to and forming part of this Application.

E.3 SUMMARY OF RESPONSES

Responses to the system reinforcement project were received over the two year planning period. Specific issues are identified in the following discussion.

E.3.1 Analysis of Location Alternatives

Public response to the substation alternatives appeared to identify a preference and support for reinforcement at Clayburn, based on the following:

- A preference was expressed by the Agricultural Land Commission and Sumas Prairie residents not to use productive farmland for any aspect of the proposed intertie and substation projects. Through the process of elimination of sites that could potentially impact agricultural land, Clayburn appeared to be the most suitable location.

- Local and regional governments stated a preference for expanding the existing substation site at Clayburn versus establishing a new site.

- Response at public meetings and in discussions with interest groups tended to favour development of the existing substation at Clayburn.

- Other potential sites were ruled out with the wind down of the intertie studies and as a result of technical and environmental analysis.

E.3.2 Impact to Surrounding Land Use

Although land for the substation reinforcement at Clayburn was acquired in 1979, a variety of developments have occurred in the surrounding area. This includes residential development approximately 300 metres to the north and west, proposed playing fields to the south and industrial development along the highway corridor to the east.

The District of Matsqui has stated that plans for the playing fields are conceptual at this stage and would not likely be affected by the reinforcement project. B.C. Hydro has noted that, where possible, the proposed playing field area would be avoided when determining tower locations.

E.3.3 Substation and Transmission Line Loop Design

A few comments were received regarding the size of the tower structures, the area required for substation addition, its visual impact, and how it would be screened and protected from public view and access.

These concerns were addressed directly in consultation with the concerned individuals.

E.3.4 EMF Effects

Several residents in the Clayburn area expressed concern that the system reinforcement could result in increased health risks to residents living in the vicinity of the substation. The project team responded by noting that EMF levels would be confined primarily to the right-of-way, some

300 metres from the nearest residence. While concerns about the possible health effects of EMF are not resolved, the consultant noted that once participants understood the scope of the project, their concerns appeared to be addressed.

E.3.5 Property Values and Visual Impacts

Approximately six residents expressed concern that substation expansion would lead to a decline in the market value of properties due to potential visual impacts. Some residents noted, however, that there are already a number of industrial activities within their viewscape (e.g. existing transmission lines, transfer station and recycling depot), and that the substation expansion would not make a significant difference.

E.3.6 Other Concerns

A few participants expressed a concern that the purpose of the substation was to facilitate a transmission line intertie to the United States. The project team responded noting that the substation reinforcement is needed for domestic purposes.

One resident expressed scepticism about the public involvement process and that B.C. Hydro had "fast tracked" the process. Once this participant learned that public involvement had been taking place since 1989, the concern appeared to be resolved.

E.4 CONCLUSIONS

The public involvement process took place over a two-year period, initially as part of consultations for the proposed intertie with PSPL. Throughout the consultation process, public interest in the substation project appeared to be minimal and relatively few concerns were expressed about the selection of Clayburn as the most suitable site. There was a preference for expansion at Clayburn Substation over other alternatives. Where concerns were encountered, efforts were made to work with the public on an individual basis to address and resolve issues.

GLOSSARY

ACSR	-	Aluminum Conductor Steel Reinforced
ASC	-	Aluminum Stranded Conductor
asphyxiant gas	-	A gas which can cause suffocation.
dB and dBA	-	Decibels and decibels, A scale; unit of measurement of electronic and audible signal and noise levels.
EMF	-	Electromagnetic Fields
kV	-	Kilovolt (one thousand volts), i.e. 500 kV is 500,000 volts.
MCM	-	Mili circular mils; measurement of the cross-sectional area of a conductor
MVA	-	Megavolt-Amperes
MW	-	Megawatt (one million watts); a watt is the unit for measuring electrical power or the rate of generating, transmitting or consuming electricity.
passerine birds	-	Perching birds, usually of small size (e.g. sparrow)
PIR	-	Public Information Request
raptors	-	Birds of prey (e.g. eagle, hawk)
riparian	-	Land immediately adjacent to a river or stream bank.
series compensation	-	Capacitor banks inserted in the line to reduce the line's effective opposition to the flow of electricity. This increases the line's electricity transfer capability.
VAR	-	Volt Ampere Reactive
VHF	-	Very High Frequency

viewshed - The area or space capable of being seen from a specific standpoint.

waterfowl - Birds frequenting water.

REFERENCES

1. Fraser Valley System Reinforcement Project, Justification Report, B.C. Hydro, June 1991.

2. Fraser Valley System Reinforcement Project, Technical Report, B.C. Hydro, June 1991.

3. Fraser Valley System Reinforcement Project, Environmental Planning and Assessment Report, B.C. Hydro, June 1991.

4. Fraser Valley System Reinforcement Project, Report on the Interministerial Referral Process, B.C. Hydro, June 1991.

5. Fraser Valley System Reinforcement Project, Public Consultation Program, Context Research Ltd., 29 July 1991.

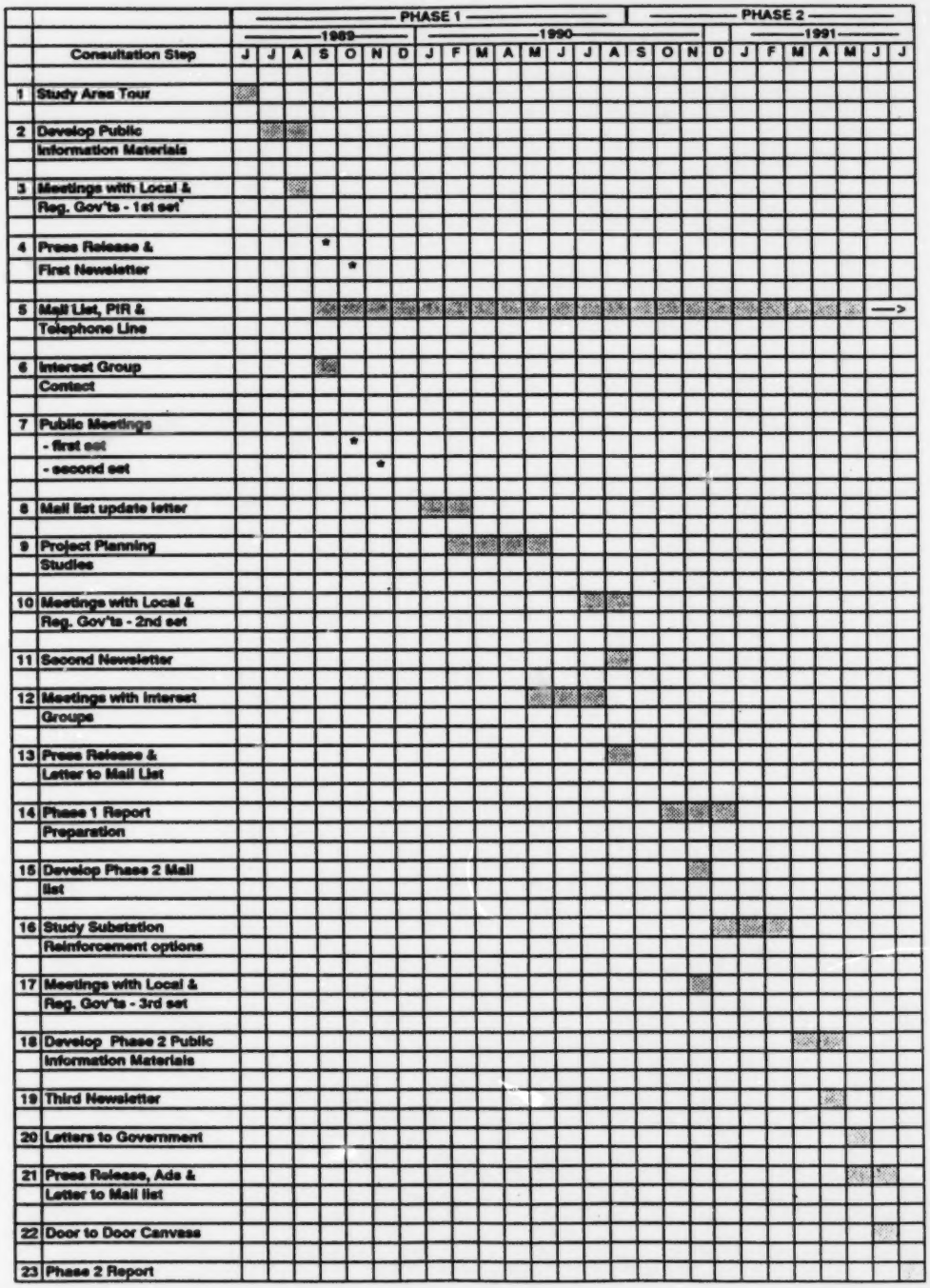
TABLE 1
FRASER VALLEY SYSTEM REINFORCEMENT PROJECT
CONSTRAINT RATINGS* OF ALTERNATIVES

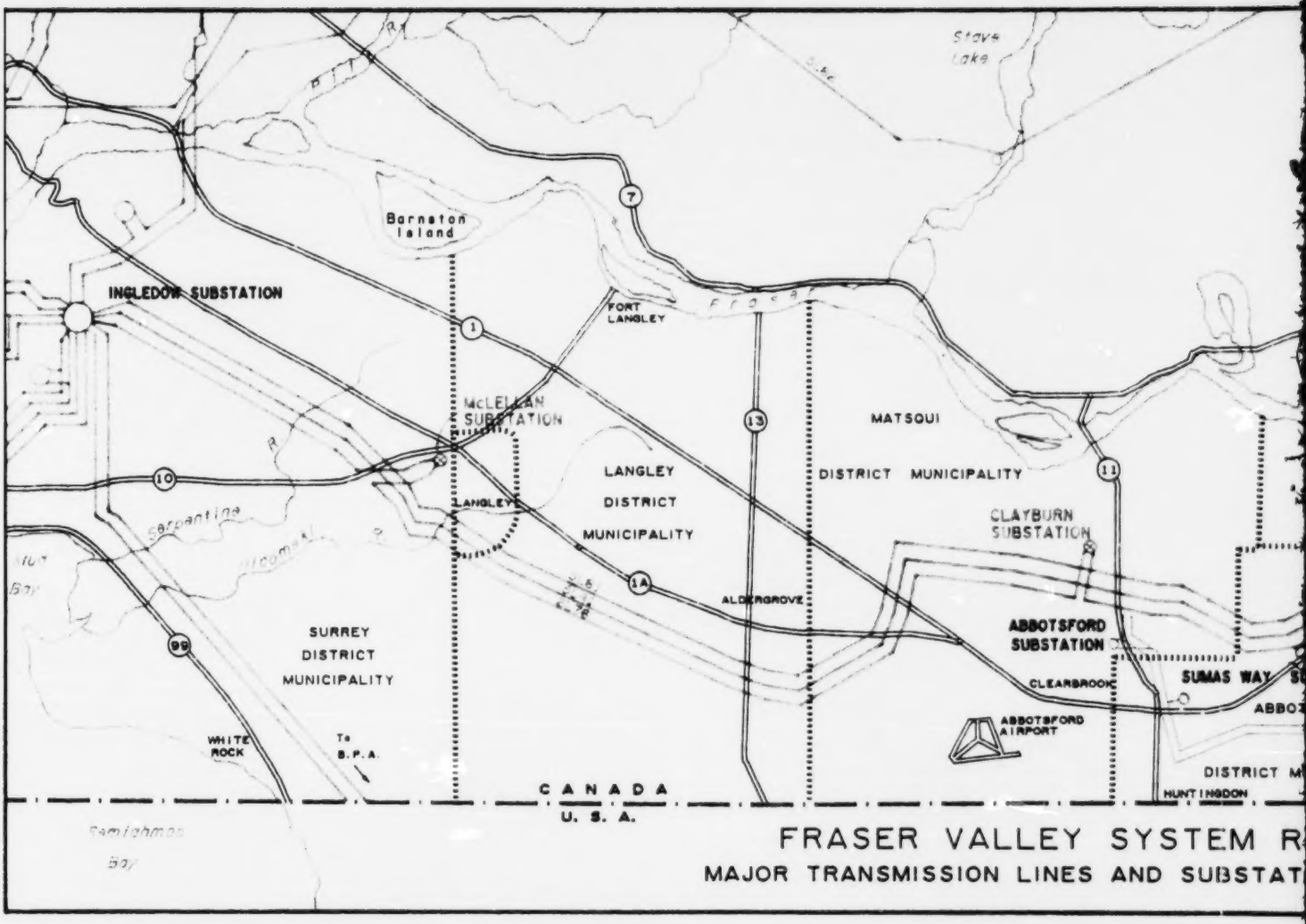
CRITERIA / ALTERNATIVES	Environmental Constraints	Technical/ Engineering Constraints	Cost Constraints	Land Use/ Social Impacts	Risk of Not Meeting 1994 In-Service Date	Visual Impacts	Risk of Not Meeting Long Term Electricity Needs
Atchelitz Expansion to 500 kV	M	L	M	H	M	L	H
Clayburn Expansion to 500 kV	L	M	M	M	L	M	L
McLellan Expansion to 500 kV	M	M	H	L	M	L	M
230 kV Transmission line from Ingledow to McLellan	M	H	M	H	H	H	M
Series Compensation on 3L2	M	M	L	M	L	M	H
Static VAR Compensators (SVC) at Clayburn	L	M	M	L	L	L	H

* Constraint Ratings

H - High constraint or potential impact
M - Moderate constraint or potential impact
L - Low constraint or potential impact

Table 2 - Public Consultation Program
Key Steps




Stave Lake
Barnston Island
INGLEDOW SUBSTATION
FORT LANGLEY
McLELLAN SUBSTATION
LANGLEY DISTRICT MUNICIPALITY
LANGLEY
MATSQUI DISTRICT MUNICIPALITY
CLAYBURN SUBSTATION
ALDERGROVE
ABBOTSFORD SUBSTATION
CLEARBROOK
SUMAS WAY
ABBOTSFORD AIRPORT
SURREY DISTRICT MUNICIPALITY
WHITE ROCK
To B.P.A.
CANADA
U. S. A.
HUNTINGDON
Semiahmoo Bay
FRASER VALLEY SYSTEM R
MAJOR TRANSMISSION LINES AND SUBSTAT

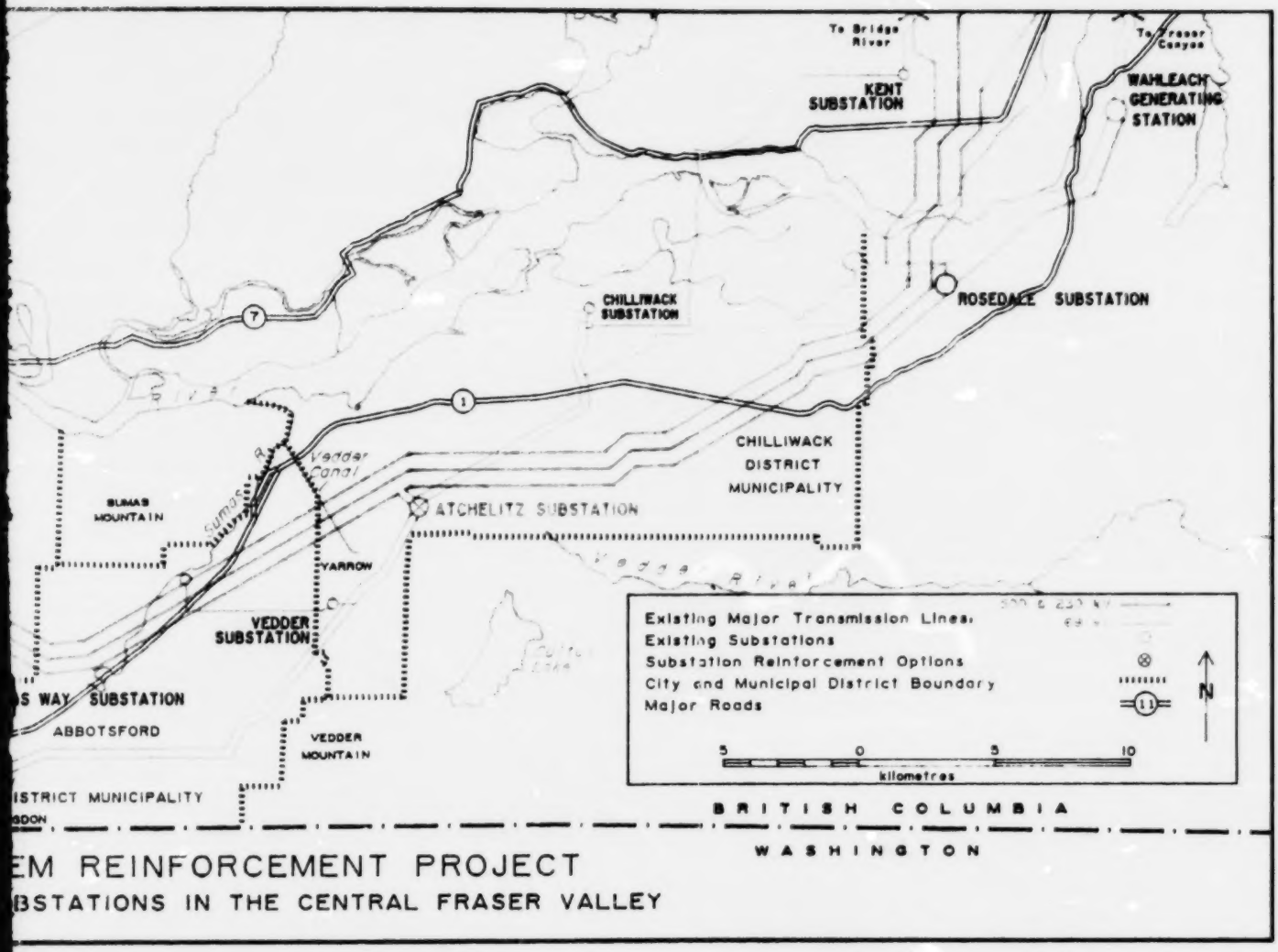
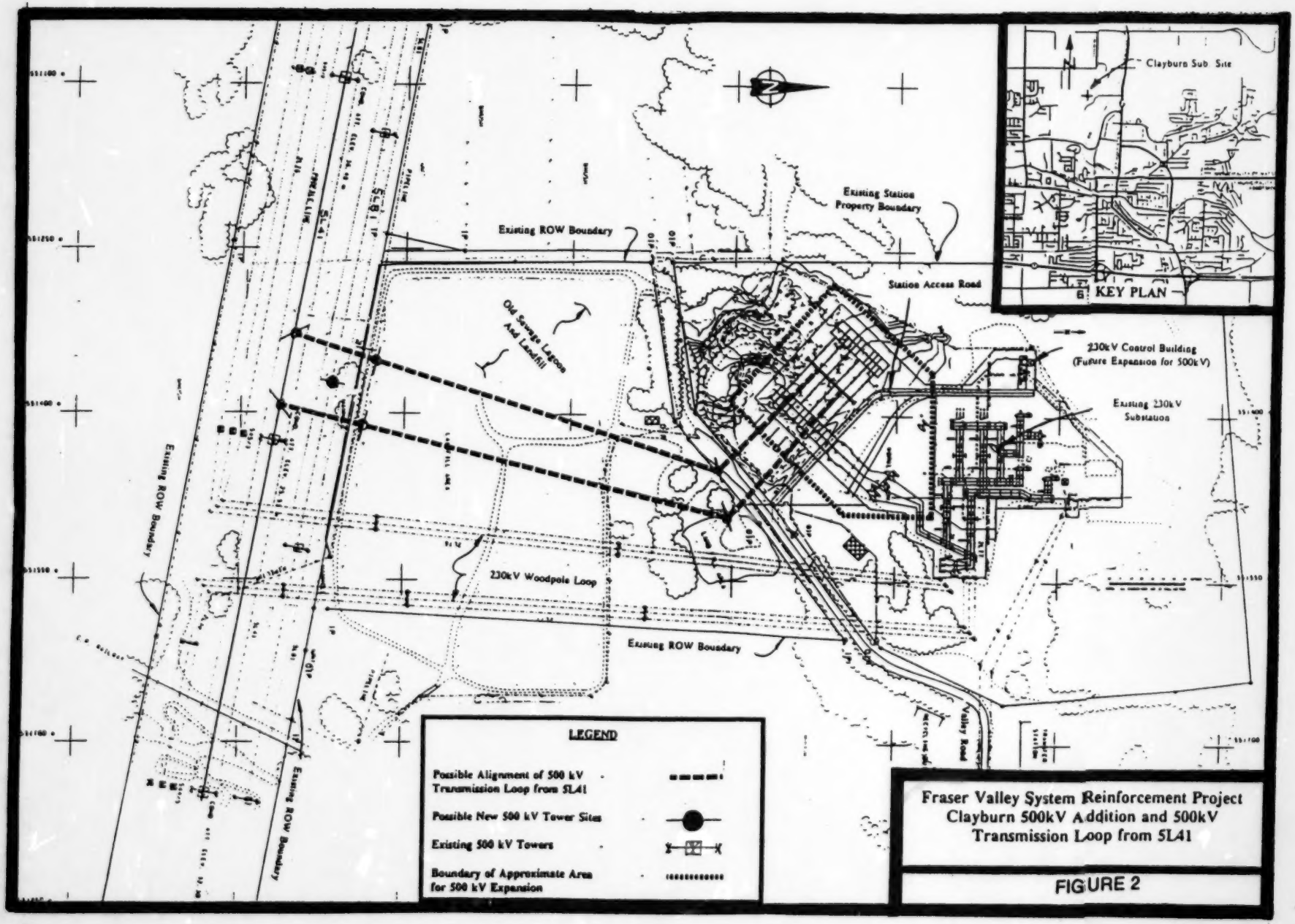
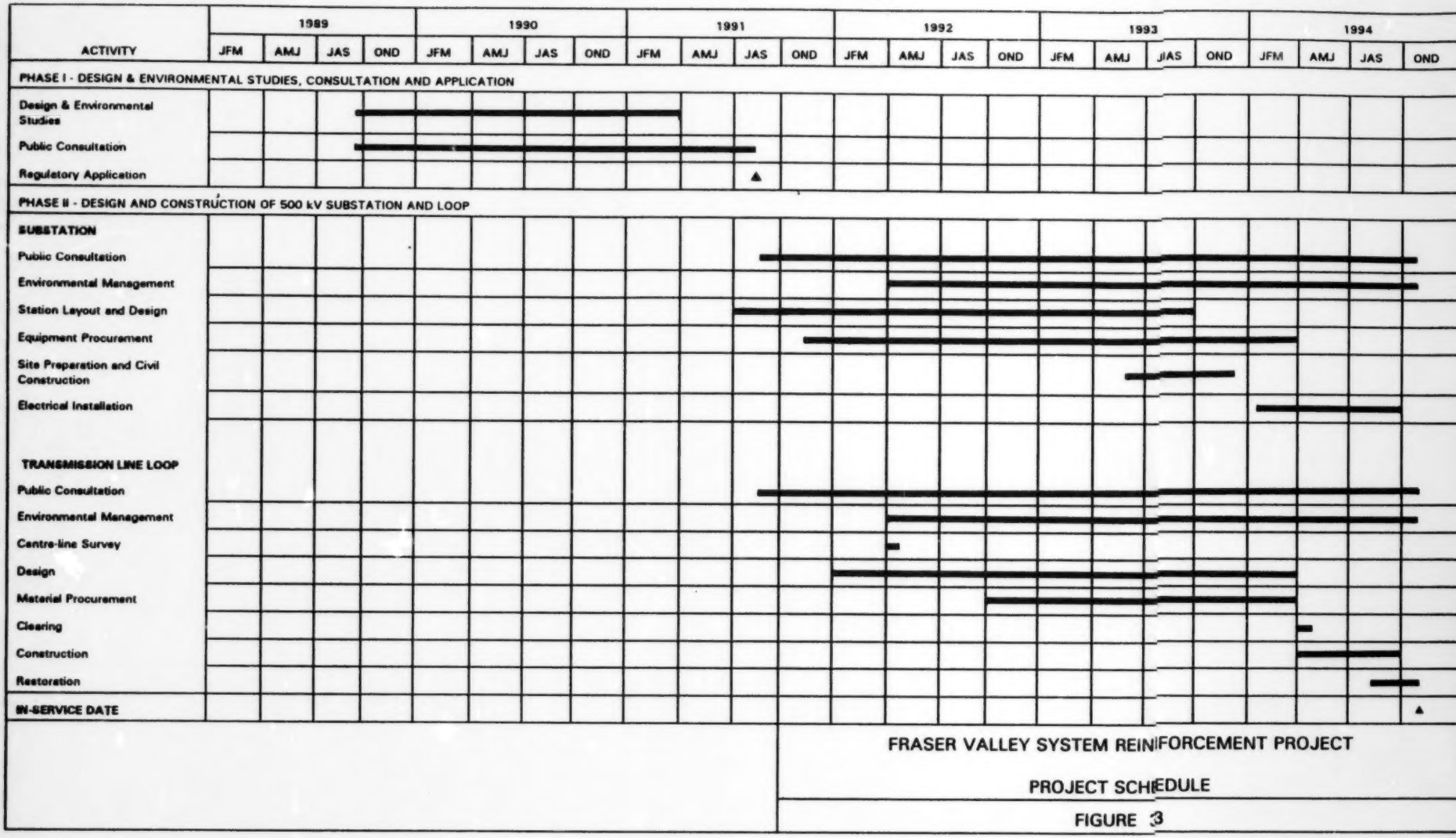

To Bridge River
To Fraser Canyon
KENT SUBSTATION
WAHLEACH GENERATING STATION
CHILLIWACK SUBSTATION
ROSEDALE SUBSTATION
CHILLIWACK DISTRICT MUNICIPALITY
ATCHELITZ SUBSTATION
SUMAS MOUNTAIN
YARROW
VEDDER SUBSTATION
S WAY SUBSTATION
ABBOTSFORD
VEDDER MOUNTAIN
ISTRICT MUNICIPALITY
Existing Major Transmission Lines
Existing Substations
Substation Reinforcement Options
City and Municipal District Boundary
Major Roads
5 0 5 10
kilometres
N
BRITISH COLUMBIA
WASHINGTON
EM REINFORCEMENT PROJECT
BSTATIONS IN THE CENTRAL FRASER VALLEY

FIGURE 1


Clayburn Sub. Site
KEY PLAN
Existing Station Property Boundary
Existing ROW Boundary
Station Access Road
Old Sewage Lagoon And Landfill
230kV Control Building (Future Expansion for 500kV)
Existing 230kV Substation
Existing ROW Boundary
230kV Woodpole Loop
Existing ROW Boundary
Existing ROW Boundary
Valley Road
LEGEND
Possible Alignment of 500 kV Transmission Loop from SL41
Possible New 500 kV Tower Sites
Existing 500 kV Towers
Boundary of Approximate Area for 500 kV Expansion

Fraser Valley System Reinforcement Project
Clayburn 500kV Addition and 500kV Transmission Loop from 5L41

FIGURE 2



FRASER VALLEY SYSTEM REINFORCEMENT PROJECT

PROJECT SCHEDULE

FIGURE 3